REMARKS

Claims 1-4, 6-9, 11-15 were rejected in the present patent application. Applicant has amended claims 1, 6, 8, and 12 and cancelled claims 7 and 13-15. Applicant respectfully requests reconsideration of pending claims 1-4, 6, 8, 9, and 11-12 in the present patent application in view of the amendments and remarks.

Rejection under 35 USC 112, second paragraph

Claims 1-4, 6-9, 11-15 were rejected under 35 USC 112, second paragraph. In response, Applicant has amended the claims and presents the amended claims to overcome the Examiner's rejection. Claims 7, 14, and 15 have been canceled.

Rejection under 35 USC 102(b)

Claims 1, 7, and 8 were rejected under 35 USC 102(b) as being anticipated by Lee et al. Claim 7 has been canceled. Applicant respectfully disagrees with the rejection of these claims. In particular, Applicant submits that the Lee does not anticipate claim 1 because Lee fails to teach, describe, or suggest the limitations:

"coupling said optical gain chip to a silicon-dioxide and silicon-oxynitride based waveguide, wherein said waveguide terminates in an external feedback element, said step of coupling further comprises:

using a flip-chip aligner-bonder to horizontally align the coupling of said gain chip to said waveguide; and

using a plurality of micromachined stand-offs to vertically align the coupling of said gain chip to said waveguide"

The Examiner cited that the Lee patent discloses the major components and/or steps cited in the claims of the present invention. However, Applicant submits that there are several key differences between the teaching of the Lee patent and the present invention as claimed.

First, Applicant submits that the present invention as claimed specifies a method comprising steps for precisely aligning the gain chip to the waveguide. This precise alignment is required for the hybrid laser to meet the stringent standard of minimal loss. In particular, the Lee patent does not teach "using a plurality micromachined stand-offs to vertically align" the coupling of the gain chip to the waveguide.

It is known in the art that, to have an effective hybrid laser, the gain chip must send light to the feedback element (Bragg grating or otherwise) fabricated in the external waveguide and get some of the light reflected back with minimal loss in between. This is important point because the loss occurs twice on the way from the gain chip and back. To minimize the loss, the mode sizes of the external waveguide and the laser needs to be well matched (i.e. be nearly equal) (Page 15, last paragraph). The typical mode size of a semiconductor laser is 2 micron wide by 0.7 micron tall. So the external waveguide mode is approximately same size and the vertical alignment must be good to +/- 0.2 micron (page 16 of the specification describes the precise alignment needed to achieve a coupling loss of less than 1 dB). Using micro-machined standoffs makes this possible.

In contrast, Lee does not teach such a technique for vertically aligning the laser. Since the Lee patent is focused on making hybrid optical integrated circuits, the precision

required is much less than that of the present invention. Lee describes using standoffs that are formed by electroplating (col. 8, lines 34-37). This technique generally does not allow good control of the deposited layer thickness, with usually a range of 0.5 micrometer accuracy for 5 micrometer tall stand offs. Bumpy surface on the standoffs made by electroplating may also add more inaccuracy. In contrast, the present invention uses stand-offs that are micro-machined to generate vertical alignment within 0.2 microns accuracy.

In terms of size, the typical size of a waveguide in optical integrated circuit is about 10 micrometers tall (Col 2, line 65). So the external mode in the Lee circuit should be of approximately same size, which is almost an order of in magnitude bigger than the external mode of the present invention (in the 2 micron range). Applicant submits that for 10 micrometer tall external mode such as the Lee device, a 2-3 micrometer misalignment may not make much difference. In contrast, the alignment precision of the present invention has to be around the 0.2 range to achieve the desired effect of narrow linewidth in the hybrid laser.

Furthermore, Lee does not describe a "waveguide terminates in an external feedback element." In terms of functionality, the lasers in Lee provide lasing action independent of the external wayeguide circuits. Unlike the feedback element in present invention, the external circuit in Lee adds functionality, but is not controlling or causing the laser action. In Lee's case, there is on the feedback element defined in the external waveguide to affect the lasing action. For this reason also, the loss due to mode mismatch between the laser and the waveguide occurs only once when the light is emitted from the laser into the external circuit. Unlike the present invention, there is no reflection

in the Lee device. Hence the precision required by the Lee device is much less than that of the present invention.

Rejection under 35 USC 103(a)

The Examiner has rejected claims 2-4, and 6 under 35 USC 103 as being unpatentable over Lee ('281) in view of Bestwick ('210). Applicant respectfully disagrees with the basis that Examiner used in rejecting these claims. As Bestwick does not teach the use of micromachined standoffs, the *prima facie* rejection of these claims based combination of Bestwick and Lee cannot be maintained. As claim 12 now depends on claim 3, its 103(a) rejection is overcome as well.

The Examiner has rejected claims 9 and 11 under 35 USC 103 as being unpatentable over Lee ('281) in view of Freeman ('793). Again, the same arguments apply to these claims with regard to Lee. As Freeman does not teach the use of micromachined standoffs and overcome the lack of teaching of these elements in Lee, the *prima facie* rejection of these claims based combination of Freeman and Lee cannot be maintained. Their 103(a) rejection is overcome as well.

CONCLUSION

The Examiner has rejected claims 1-4, 6-9 and 11-15. Applicant has amended claims 1, 6, 8, and 12, cancelled claims 7, 13-15, and replied to the Examiner's rejection. Applicant respectfully requests reconsideration of pending claims in the present patent application in view of the amendments and remarks. Applicant submits that pending claims 1-4, 6, 8, 9 and 11-12 are now in a condition for allowance.

Respectfully submitted,

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